Surface acoustic wave spectroscopy as a new tool for quality control and research of additively manufactured materials

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Abstract

Laser-induced acoustic surface wave spectroscopy allows quick and non-destructive access to elastic properties of coatings, surfaces and surface-near bulk materials. Furthermore, the mechanical weakening due to cracks, pores and delamination can be evaluated, as they influence the propagation of surface waves as well. Therefore, the method is a quick and powerful tool for surface characterization and can be found today in research and development, quality control and as a precise and scientific reference method.

After successful application of the method to semiconductor materials and PVD coatings in the thickness range of few micrometers [1], recent works showed that using different sensors the thickness range can be extended to at least 500 µm. That allows measurement of thicker coatings and bulk properties of freestanding build up structures made by laser cladding, powder bed processes, and thermal spraying.

Different mechanical properties, depending both on location and measured direction, show the direct influence from processing parameters, such as temperature distribution and build up direction. In this work, several application examples are shown for both research and quality control, demonstrating high potential for industrial application.

Literature

[1] D. Schneider, in Handbook of Advanced Nondestructive Evaluation (Eds: N. Ida, N. Meyendorf), Springer International Publishing, Cham, 2019, pp. 171–234.